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ABSTRACT

Some of the arguments for and against an industrial policy to invigorate the new High Definition Television (HDTV) industry are reviewed, arguing that the potential impact of an HDTV industry on the U.S. economy has been overstated and that the industry, considered to have great potential for educational and other uses, will cost consumers much more than conventional television while only providing limited benefits. It is further argued that, by setting standards to establish an HDTV industry, the Federal Communications Commission (FCC) may stimulate manufacture of sets by foreign countries that will have negative impacts on the U.S. economy. The history of HDTV development is traced, and probable costs and benefits are outlined. A market for HDTV will not develop unless programming is available. By setting a standard and a mandatory phase-in period, the FCC will guarantee a market and programming, and the industry will no longer be reluctant to produce the receivers and auxiliary equipment needed. It is probable that an industrial policy will cost consumers billions of dollars for a negligible and unsought improvement in their lives with no likely recovery in the American consumer economics industry. (SLD)

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HDTV DEBATE: INDUSTRIAL POLICY GONE AWRY

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Introduction

In the last decade, high-definition television (HDTV) has been one of the most discussed emerging consumer technologies. Congressional committees held numerous hearings on HDTV from 1989 through 1991. One of the prominent aspects of these hearings was the role of government in helping to guide and promote this developing technology. Both within and outside the electronics industry, HDTV was vigorously promoted as an appropriate vehicle for a national industrial policy.[1] But there also was opposition to any government role in charting an industrial policy for HDTV. That debate has subsided somewhat since the focus has shifted to choosing an HDTV technology. The issues remain important, however, and productive resources, albeit mostly private ones, are being expended to establish an HDTV standard for use on another productive resource: the radio spectrum. Another reason the industrial policy issue merits renewed inspection is the Federal Communications Commission's (FCC) intent to effectively force consumers to convert to HDTV by phasing out the current television standard.[2]

This paper will re-examine some of the arguments for and

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[1]Industrial policy as defined by the U.S. International Trade Commission is "coordinated government action to direct productive resources to help domestic producers in selected industries become more competitive." Cynthia A. Beltz, High-Tech Maneuvers: Industrial Policy Lessons of HDTV 6 (1991) (footnote omitted).

[2]See, e.g., Bob Davis, FCC to Grant Owner of Every TV Station Another License, Wall St. J., March 18, 1992, at A1, A6.

against an industrial policy to invigorate the nascent HDTV industry. It is the thesis of this paper that the potential impact of an HDTV industry on the United States economy has been overstated, setting unrealistic expectations, and, more important, that the industry will cost consumers billions of dollars more than would current television technology with questionable benefits. Moreover, it can be argued that by setting standards to establish an HDTV market, the FCC may stimulate manufacture of sets by foreign companies that will have a negative impact on the United States economy.

The economic impact of emerging telecommunications technologies is of concern because numerous policy decisions are framed on this basis. Although many choices have been or are being considered regarding various aspects of HDTV, such as spectrum use, digital versus analog transmission, international standards and even industrial policy, the issue of the impact of a national HDTV policy on United States consumers largely has been neglected. The vast majority of scholarship in the HDTV field is in the economic and technological areas; few articles have appeared in scholarly journals in the mass communications field. Perhaps this is because of the fluid nature of both the political process and technology.

Finally, and most recently adding to the renewed importance of research in this area, the election of Gov. Bill Clinton as President may portend a changing governmental attitude toward high-definition television. Not insignificantly, Vice President

Al Gore was a strong proponent of a government policy promoting telecommunication technologies, including HDTV, while he was chair of the Subcommittee on Science, Technology, and Space of the Senate's Commerce, Science and Transportation Committee.[3]

Background[4]

High-definition refers to technological improvements increasing the resolution of televised images. Current NTSC (National Television Systems Committee) transmission standards, which were established in 1941, provide a nominal 525 scanning lines for each television image, which are transmitted at a rate of about 60 fields per second, which is equivalent to nearly 30 frames[5] per second. NTSC is the standard in North and South

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[3]"It is apparent to this senator that the United States of America cannot allow HDTV to slip by; that while private industry is key, the Federal Government has to provide at least an initial impulse, but that it is not certain government will step up to this challenge unless encouraged by Congress." High Definition Television: Hearing Before the Subcomm. on Science, Technology, and Space of the Senate Comm. on Commerce, Science, and Transportation, 101st Cong., 1st Sess. 2 (1989) (statement by Sen. Al Gore, subcomm. chair) [hereinafter Gore hearings].

[4]For a description of the development of NTSC, PAL and SECAM standards see generally Erik Barnouw, A History of Broadcasting in the United States, 3 vols. (1966-1970). For a description of HDTV's development and proposed standards see, e.g., David J. Schaefer & David Atkin, An Analysis of Policy Options for High-Definition Television, Telecommunications Policy, Oct. 1991, at 411, 412-421

[5]A frame, as with film, is a single complete image. Each field represents a single pass by the electron beam in a cathode-ray picture tube. The electron beam in a television set stimulates alternate rows of phosphors with each pass to make up each television image. Therefore, two passes, or fields, are needed to complete each image. This is known as interlacing, and it can lead to the moiré pattern often seen when a striped shirt,

America and Japan. The primary transmission standard in the rest of the world, known as PAL (phase alternation line) has a significantly better resolution at 625 lines but a slower 25 frames per second and requires 8 MHz of bandwidth compared to the 6 MHz used by NTSC. A third system, used primarily by France and its dependencies and countries of the former Soviet Union and its allies, is SECAM (système électronique couleur avec mémoire). SECAM has 819 lines per frame and requires 14 MHz of bandwidth for each channel. In addition to a greater number of lines, PAL and SECAM improve on the color capability of the NTSC standard. The primary reason for the different standards is that when color was being developed, the FCC required that it be compatible with then existing black and white television sets. This was to prevent the wholesale obsolescence of the established base. European countries, recovering from the ravages of World War II, did not have as large a base of television receivers in use and, thus, could afford to eliminate them in favor of superior systems.

Some of the HDTV transmission systems proposed for the United States or in operation in Europe or Japan would approximately double the present resolutions and add digital

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for example, appears to shimmer. The different field rates are based on the number of cycles per second, or frequencies, used in alternating current electrical power systems in various areas, e.g., a rate of approximately 60 Hz rate is used in the United States and a 50 Hz rate is used throughout Europe. Thus, to avoid the expense of converting the electrical system's frequency, the frame rates for the different television systems are half the cycles per second used in the electrical system.

stereo sound. The common frame of reference is that an HDTV image has the clarity and detail of a 35mm movie image. However, some who have seen it are not so impressed.[6] Film director Francis Ford Coppola, who has experimented with high-definition video production, has said standards under consideration in the United States are "nothing but souped-up NTSC."[7]

HDTV would be similar to motion picture film in one respect. All standards under review use a wide-screen format with a movie-like 16:9 aspect ratio (the ratio of screen width to screen height), compared to the present 4:3 worldwide television standard. The wide-screen format would eliminate the need to crop the sides of movie images or use a "letterbox" format when films, either broadcast, videotape or laser disk, are displayed on television sets.

Japan's NHK broadcasting corporation began investigating higher resolution television images in 1964. By 1984, Sony was selling HDTV production equipment, and in mid-1989, NHK began

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[6]Joseph Farrell & Carl Shapiro, Standard Setting in High-Definition Television, Brookings Papers on Economic Activity 1992, at 1, 74. "While the resolution is certainly much better than NTSC resolution, we do not agree that it could be compared with 35 millimeter film." Id. at 74.

[7]Paula Parisi, A Conversation with Coppola, American Cinematographer, Aug. 1991, at 71. Coppola says that an HDTV standard would need about 2,000 lines to be equivalent to the resolution of 35mm film. "Unfortunately, everyone's arguing not to make it better, but to make it worse. They're saying that it's not even necessary that it be as good as it is, where as a filmmaker, I'm saying it's just on the edge of being good enough," Coppola declares. Id.

one-hour experimental high-definition satellite broadcasts.[8] On November 25, 1991, Japan began broadcasting high-definition programming eight hours a day.[9] In addition, Japanese companies are the only commercial producers of HDTV receivers. The Japanese system, known as MUSE (Multiple Sub-Nyquist Encoding), has 1,125 lines of resolution and a 60 Hz field rate. The analog programs are transmitted over the MUSE direct broadcast satellite system.

Europe also has been developing an HDTV system. In 1986 the Eureka Project 95, led primarily by NV Philips Co. of the Netherlands and Thomson SA of France, was formed.[10] The Europeans were seeking an analog system that would be compatible with the current PAL and SECAM standards. Recently, the Europeans began worrying that a digital standard may supersede the already-developed HD-Mac analog standard.[11]

The United States entered the race to set HDTV standards later than Japan or Europe, but like them started by considering incremental improvements to the existing analog television system. For example, RCA's Sarnoff labs spent $40 million between the late 1970s and mid-1987 on advanced television

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[8]U.S. Congress, Office of Technology Assessment, The Big Picture: HDTV and High-Resolution Systems (1990) 27 [hereinafter The Big Picture].

[9]Elizabeth Corcoran, Picture Perfect, Scientific American, February 1992, 94, 96.

[10]Id. at 32-33.

[11]Andrew Hill & Michiyo Nakamoto, Troubled Transmission for the Big Picture Show, Financial Times, Nov. 17, 1992, at 17.

research. CBS and other smaller groups also did research and development work.[12] However, as computer software technologies, particularly data compression, improved in the late 1980s and early 1990s, it became apparent that a digital system offered both superior performance and opportunities for integration with computers not available with analog systems. (However, a digital system would not be back-compatible with existing NTSC receivers. Therefore, to continue receiving television signals, consumers would be required to buy new sets or converters.) That digital insight helped the United States leapfrog Japan and Europe and gain the lead in the international race to develop an HDTV standard for mass market receivers.

The Industrial Policy Issue

Within three minutes of opening a congressional hearing on HDTV on Oct. 8, 1987, Rep. Edward J. Markey of Massachusetts, chairman of the Energy and Commerce Committee's Telecommunications and Finance Subcommittee, raised an issue related to industrial policy that has dogged the HDTV debate ever since:

> First and foremost, I am puzzled why the American consumer electronics manufacturers are so far behind their Japanese and European counterparts in developing competitive HDTV systems. . . . One question that I believe needs an answer is whether American industry will become involved in this industry or whether we will be nonplayers as we are in so many other electronic industries? We in the Congress, along with the Federal Communications Commission, also need to

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[12] Id. at 34-35.

> confront the issue of whether we will develop standards for HDTV or whether we will let the marketplace make the determination for us.[13]

Markey's concern for the United States consumer electronics industry was well founded. Japan's high-definition system, the culmination of a billion dollars in research funding during more than 20 years, was demonstrated in the United States in January 1987. It was the world's only operational system.[14] Moreover, 87 percent of the 19 million color television sets sold annually in the United States are made by foreign-based firms.[15]

On November 17, 1987, the FCC formed the Advisory Committee on Advanced Television Service (ACATS) to advise it on technical and public policy issues. Committee Chair Richard Wiley's initial report in June 1988 noted the "opportunities available to American industry . . . ranging from creative activities, proponent system development, receiver manufacture, receiver assembly [and] component manufacture. . . ."[16] However, Markey

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[13]High Definition Television: Hearings before the Subcomm. on Telecommunications and Finance of the House Comm. on Energy and Commerce, 100th Cong., 2 (1987) (statement by Rep. Edward J. Markey, subcomm. chair) [hereinafter Markey hearings].

[14]Id. at 40 (statement of Fred Paxton, chair of Association of Maximum Service Telecasters).

[15]Id. at 326 (statement of Charles G. Schott, III, deputy assistant secretary for communications and information, National Telecommunications and Information Administration, U.S. Department of Commerce).

[16]Id. at 348 (statement of Richard C. Wiley, chairman of Federal Communication Commission Advisory Comm. on Advanced Television Service, and attached Interim Report). While Wiley acknowledged that HDTV involves more than receivers and represents more than just a consumer product, it is outside the scope of this paper to go beyond the consumer issue.

told Wiley the report was deficient in covering the trade implications for HDTV. Wiley responded that the responsibility for a trade plan rested with industry, but he acknowledged a weak United States electronics industry "may not be a factor in the manufacture of receivers."[17] There is an established base of television sets in the United States valued at $80 billion.[18] With a planned phase-in of HDTV over five years (and the expected phase-out of NTSC over 15 years), that base will need to be completely replaced or consumers will have to purchase signal converters.[19] In addition, HDTV receivers will cost more for the same size set; some estimates are 30 percent more at full production.[20] And because of HDTV's improved image resolution, consumers are expected to replace their current NTSC receivers with sets having larger screens than they presently use, again adding to the cost. Among consumers alone, the national investment in HDTV over 15 years may exceed $100 billion. Calculated another way, if the average cost of HDTV receivers is

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Nevertheless, the consumer aspects of HDTV are of primary significance because the FCC is endeavoring to set a standard for television, which ultimately is a consumer product, and the consumer market is inherently huge.

[17] Id. at 371-72 (testimony of Wiley).

[18] Id. at 39 (testimony of Paxton).

[19] Second Report and Order/Further Notice of Proposed Rule Making, 7 FCC Rcd. 3340, 3353 (1992). See also Memorandum Opinion and Order/Third Report and Order/Third Further Notice of Proposed Rule Making, 7 FCC Rcd. 6924, 6926-28, 6931, 6980-99 (1992).

[20] Markey hearings, supra note 13, at 21 (testimony of Richard Green, senior vice president of Public Broadcasting Service). (Green is now president of CableLabs Inc. in Boulder, Colorado.)

$3,500[21] (Sharp announced an $8,000 unit in early 1992, but costs certainly will decline with competition and economies of scale[22]), and the present 150 million United States television sets are replaced, total conversion will cost $525 billion. Another estimate puts the worldwide market for HDTV receivers at $150 billion annually in 20 years.[23] It should be noted that even without HDTV most consumers are likely to replace their current television sets within 15 years as the picture tubes age or new models come out. Thus, while the important figure for consumers is the incremental cost increase for HDTV sets over and above NTSC receivers, it is impossible to know precisely what that premium will be. Nonetheless, the gross figures are an indication of the size of the market. And it is these large figures that make the trade and industrial policy debate so important for the United States economy.

At a hearing before the Science, Technology and Space Subcommittee of the Senate's Commerce, Science and Transportation Committee, Pat Hill Hubbard of the American Electronics

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[21]A group reporting to the Advisory Committee on Advanced Television Service uses a figure of $3,700 per set, based on 14.7 percent of average per capita income, the same percentage as represented by the retail price of a color television set in 1966 when complete prime-time color programming by the three major networks was achieved. Working Party 5, Planning Subcomm., Advisory Comm. on Advanced Television Service, F.C.C., Market Penetration of HDTV 4 (1992).

[22]Sharp Cuts Price of Advanced TV, N.Y. Times, Feb. 1, 1992, at A37.

[23]Lee Smith, Can Consortiums Defeat Japan? Fortune, June 5, 1989, at 254.

Association (AEA), an industry trade group, told Chair Al Gore that United States industry needed to capture 50 percent of the HDTV receiver market in the United States to remain competitive in computers and semiconductors, industries closely linked to HDTV. The only United States company that still manufactures television receivers is Zenith, and it holds just 10 percent of the market.[24] The enormity of the task facing the United States electronics industry is daunting. However, the AEA now says the HDTV market will not be a critical one for semiconductors, and that there is difficulty in "picking an industry on which economic progress and national competitiveness will depend."[25]

If government and industry are two legs of the HDTV stool, consumers are the third. Without consumer acceptance, HDTV will not have the support it needs to succeed. And this is where the government policy on HDTV ultimately breaks down. As Europeans also are beginning to wonder: "[A]re EC consumers and the consumer electronics industry really interested in a new standard, or do they simply need a new product — in this case wide-screen television — to kick-start an ailing market?"[26]

First, there is no direct evidence consumers will pay the sharply higher costs of HDTV sets, despite whatever virtues high definition offers. Studies on consumer preference for HDTV are limited. One 1992 study found only limited support for wide-

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[24]Gore hearings, supra note 3, at 44.

[25]Beltz, supra note 1 at 93, n.2.

[26]Hill & Nakamoto, supra note 11 at 17.

screen sets carrying NTSC programming.[27] However, another 1992 paper reporting on eight studies of the letterbox format[28] using NTSC signals concluded that "consumer reactions to widescreen images are highly favorable."[29] A 1989 Congressional Budget Office (CBO) report compares three "very optimistic" forecasts of the potential HDTV market. It also cites a 1988 MIT study of consumer reaction to side-by-side tests of HDTV and NTSC "that should temper the forecast's optimism." It concluded, without reference to costs, that "the preference for HDTV . . . is highly conditional and context dependent."[30] And the CBO, which does discuss the higher costs of HDTV sets, concludes, "[I]t is unlikely that HDTV will by itself revitalize the United States electronics sector."[31] Richard Jay Solomon, an MIT researcher, told the Senate Governmental Affairs Committee on August 1, 1989:

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[27]Joseph A. Russomanno & Robert Trager, The Narrow View of Wide Screen: Public Acceptance of Tomorrow's Television (1992) (on file with authors).

[28]Letterbox is a term denoting 16:9 images, typically movies at present, when they are shown on a 4:3 television screen. It uses black bands above and below the picture to preserve the original movie's wide-screen format. Broadcasters could use a letterbox format to simulcast images during a transition period from NTSC to HDTV. "Some TV broadcasters in North America fear they will lose audience if they broadcast programs in letterbox format; those fears are borne out in studies of consumer reaction to letterbox." Karen A. Pitts, How Acceptable is Letterbox for Viewing Widescreen Pictures? IEEE Transactions on Consumer Electronics, August 1992, at xlii.

[29]Id.

[30]Cong. Budget Office, Market Forecasts and HDTV's Impact on Other Industries, in HDTV: The Politics, Policies, and Economics of Tomorrow's Television 149, 155 (John F. Rice ed., 1990).

[31]Id. at 171.

> "What still is needed to stimulate the HDTV markets are larger and brighter high resolution displays. And such displays for the consumer market, the home market, must only have a modest cost differential beyond that of existing TV sets. . . . The study does not conclude there is no demand for HDTV. On the contrary, it concludes that there is a limited demand for expensive, relatively small cathode ray tube displays judged under normal home viewing conditions."[32]

Private-sector policy analyst Cynthia A. Beltz states: "[T]he market potential of emerging industries is inherently difficult to forecast because both demand and price are unknown, simultaneously determined variables."[33]

A June 1992 report by Working Party 5 of the Planning Subcommittee of the ACATS projects that HDTV will have a penetration of television households of 37 percent in year 10 after the FCC selects a transmission standard. That figure could rise to 56 percent if the FCC mandates timely introduction of HDTV service by broadcasters. The group bases its projection on four growth scenarios: high perceived value and high price, high perceived value and low price, low perceived value and high price and low perceived value and low price."[34] Obviously, greatest growth is projected under the high value-low price scenario. But the report states, "No truly adequate surveys of audience reaction to HDTV have been published, either because the samples were too small or the methodology was suspect. However, from the

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[32]Prospects for Development of a U.S. HDTV Industry: Hearing Before the Senate Comm. on Governmental Affairs, 101st Cong., 1st Sess., 37 (1989).

[33]Beltz, supra note 1, at 62.

[34]Working Party 5, supra note 21, at 30-31.

body of work available, it is at least clear that there exists a general preference for a wide screen display with a 16:9 aspect ratio."[35] Although some members of the panel may feel such a preference is clear, other studies suggest it is far less so. But what does seem clear is that no one yet knows what the consumer demand for HDTV will be. The panel states that the growth model for HDTV is based on the penetration rates of color television receivers and video cassette recorders. Because both color and the VCR offered substantially added benefits the model may be overly optimistic.

Another factor, as Joseph Farrell and Carl Shapiro, both of the University of California at Berkeley, point out, is the cost of the receiver:

> We are concerned that the current FCC policy will lead to very expensive HDTV. The FCC's relative inattention to cost considerations in the standard-setting process may retard the ultimate adoption of HDTV.[36]

Indeed, that standard-setting process points up another aspect of the debate over high-definition television: the issue of industrial policy. There was much antagonism during the Bush era to "industrial policy, which ranks right up there with broccoli on the White House's no-no list."[37] Commonly it was premised on opposition to the government's trying to pick

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[35]Id. at 3.

[36]Farrell & Shapiro, supra note 6, at 46-47.

[37]Campaign '92: The Hot Buttons for the Industry are Industrial Policy, Taxes, Trade, and Anti-Trust Relief, Electronics, Sept. 1991, at 40.

industrial winners and losers. But by requiring conversion to an HDTV standard, the FCC will have done exactly that. In addition, such a standard-setting process will lock in technology, discouraging further experimentation. "It is like hoping to preserve a locomotive industry by setting your own railway gauge."[38] And, as already alluded to, the FCC will have begun a competition for the consumers' dollar. But it will have done so without directly considering the impact its decision will have on such pertinent industrial policy issues as manufacturing capability and foreign trade.[39] And some argue that even if the United States sets a standard, foreign companies will dominate the industry. This is because United States industry is not prepared to manufacture television sets or many of the components for either domestic or international consumption. Thus, a United States standard and FCC-imposed market actually may improve foreign television and semiconductor industries vis-à-vis American industry positions in the United States market.

An interesting dynamic is at work in the development of new technologies. Some contend that imitators of innovators enjoy opportunities to capitalize on such innovator-borne costs as invention and market development. Others counter that a new technology can gain an insurmountable lead in a market. But such

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[38]High-Definition Television: The World at War, The Economist, Aug. 4, 1990, at 60 (hereinafter World at War).

[39]Although the FCC does not have jurisdiction over foreign trade, nothing prevents it from including such factors in its decisions.

gains can lock in inferior technology. In that situation, a strong public-sector push could promote continued research to develop new or improved competing technologies.

> The policy implications arising from this type of technological dynamic are ambiguous, however. The prospect of a new technology characterized by strong network properties that can be locked in creates . . . the Blind Giant's Quandary, a situation in which "public agencies are likely to be at their most powerful in exercising influence upon the future trajectory of a network technology just when they know least what should be done."[40]

The development of NTSC color television is an example of an inferior technology becoming locked in while Europe developed a technically superior system. The derailing by United States companies and the FCC of the international move toward analog HDTV is an example of a superior technology gaining dominance with public-sector assistance. But, as with the game theory behind the Blind Giant's Quandary, the United States should be wary of adopting a digital HDTV standard that can soon be outmoded. In less formal terms, the HDTV standard-setting process is an international game of "chicken."

One problem that must be faced up to in any argument over an industrial policy to increase United States competitiveness is what constitutes an American company. When he was a Harvard University professor, Secretary of Labor Robert B. Reich said that corporate globalization makes it difficult and unproductive

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[40]Irwin Feller, Recent Theoretical and Organizational Approaches to U.S. Technology Policy, in Technology and U.S. Competitiveness: An Institutional Focus 117, 120-21 (W. Henry Lambright & Dianne Rahm eds., 1992) (footnote omitted).

to attempt to differentiate American companies from foreign firms.

> American competitiveness can best be defined as the capacity of Americans to add value to the world economy and thereby gain a higher standard of living in the future without going into ever deeper debt. American competitiveness is not the profitability or market share of American-owned corporations. In fact, because the American-owned corporation is coming to have no special relationship with Americans, it makes no sense for Americans to entrust our national competitiveness to it. The interests of American-owned corporations may or may not coincide with those of the American people.[41]

Zenith, which employs 2,500 Americans, is the only American-owned television set manufacturer. Yet it assembles its sets in Mexico from United States-manufactured components.[42] There are more than 15,000 Americans employed by foreign-owned television set manufacturers. "We should be less interested in helping American-owned companies become technologically sophisticated than in helping Americans become technologically sophisticated," Reich argues.[43]

Another report is more blunt about American prospects: "As for HDTV's reviving the United States electronics industry, forget it. No matter who wins the contest and cashes in on the patent rights, the big money will go to the companies that actually make the new TV sets and production equipment. They are

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[41]Robert B. Reich, Who Is Us? Harv. Bus. Rev., Jan.-Feb. 1990, at 59.

[42]Gene Bylinsky, A U.S. Comeback in Electronics, Fortune, Apr. 20, 1992, at 86.

[43]Reich, supra note 41, at 61 (emphasis in original).

mostly foreign owned."[44] Thus, one of the unintended consequences of setting a high-definition standard and encouraging consumers to convert from NTSC to HDTV may be to consolidate foreign dominance over the United States electronics industry.

Zenith, which suffered financial loses in recent years, may not have the financial strength to compete,[45] although the company did sell its successful personal computer division to state-owned Groupe Bull of France to raise capital for HDTV research. It may be too late for an HDTV standard developed by Zenith, for example, to have any significant impact on American workers or the United States television industry.

Many of the efforts to restore American competitiveness are grounded on the assumption that

> U.S. technological dominance has eroded and only intensive investments in basic science and industrial innovation can restore the U.S. position in the international marketplace. The belief is that a concentrated effort in the production of new technologies — and hence new industries and products — will restore technological advantage for the United States and re-establish a technology gap between itself

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[44]Andrew Kupfer, The U.S. Wins One in High-Tech TV, Fortune, Apr. 8, 1991 at 60, 61. "[N]either the innovation of HDTV nor foreign HDTV targeting will fundamentally alter the economics of location in the television set industry for the foreseeable future. More than 60 percent of the color sets sold in the United States are made here largely by foreign-owned manufacturers with domestic value-added around 70 percent. A substantial portion of HDTV sets is also expected to made here in the future, although this could change." Beltz, supra note 1, at xii.

[45]Smith, supra note 23, at 254.

and its major competitors.[46]

This certainly seems to be the situation with HDTV. But Maria Papadakis of Syracuse University points out that subtle changes at work in the international economy make "the creation and maintenance of technology gaps . . . increasingly difficult and notions of national technological ownership decreasingly relevant."[47] She claims that the United States trails Japan in several markets, including electronics, because of "unbalanced" market volume and strength. By redefining goods in the electronics industry, for example, as low-tech and high-tech, she finds the United States performs well, contrary to public perceptions, in such high-technology areas as instruments while Japan dominates relatively low-tech but highly profitable consumer industries such as VCRs and cameras.[48] Papadakis credits Japanese investment in efficient, flexible manufacturing processes and failure of United States businesses to anticipate consumer demand for Japan's competitive advantage. She concludes: "Instead of concentrating on how the United States can open new technology gaps between itself and Japan, far more consideration should be given to narrowing the divergence in

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[46]Maria Papadakis, Changing International Relations and U.S.-Japanese Competitiveness, in Technology and U.S. Competitiveness: An Institutional Focus 133, 133 (W. Henry Lambright and Dianne Rahm eds., 1992).

[47]Id.

[48]Id. at 141.

competitive skill that is emerging between these two nations."[49] Others echo these sentiments.[50] Clearly the United States' effort to set an HDTV standard is an effort to gain technological advantage not competitive skill, otherwise the investment would be in manufacturing facilities instead of state-of-the-art broadcast standards.

Some view the problems facing adoption of HDTV from a more pragmatic standpoint. A technology crucial to HDTV is computer memory and processing chips, which some estimate may make up 40 percent of the value of a television receiver.[51] But "[e]ngineers at America's Texas Instruments, which now controls about 60 percent of the world market for digital-signal-processing chips, are skeptical of the claims for crucial synergies between HDTV and other chip markets."[52] The United States' share of the semiconductor market fell from 57 percent to 27 percent from 1980 to 1989; meanwhile, Japan's share rose from 27 percent to 52 percent. Japan's market share in dynamic random access memory chips grew even more.[53]

On the other hand, some argue that much of the handwringing over who is ahead in the chips race is overwrought. Although he

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[49]Id. at 149.

[50]See, e.g., Joseph J. Romm, The Once and Future Superpower: How to Restore America's Economic, Energy and Environmental Security 34 (1992).

[51]Japan Eyes a New Screen, The Economist, Aug. 31, 1991, at 69.

[52]World at War, supra note 38, at 59.

[53]Romm, supra note 50, at 69 (footnote omitted).

acknowledges a Japanese lead in relatively simple and inexpensive memory chips, Alfred Balk notes that the world's largest producer of semiconductors in 1988 was IBM.[54]

Gordon Moore, chairman of Santa Clara, Calif.-based Intel Corp., while proclaiming the end of Japanese domination of the semiconductor industry, notes the increasing competitiveness of other Asian countries. For example, South Korea's Samsung Electronics Co. holds 25 percent of the United States market for 4-megabit memory chips and has started shipping 16-megabit chip samples. Intel itself plans to spend $2 billion a year in 1992 and 1993 on equipment.[55]

The most recent trade figures appear to prove Moore correct. In 1992, the United States' share of the computer chip market is expected to have grown by more than 15 percent while Japan's share probably will have fallen 10 percent. That would make the United States semiconductor industry the world leader for the first time since 1984.[56] The revival of the United States semiconductor industry without the benefit of HDTV is paradoxical because one of the reasons for promoting HDTV was to resuscitate the industry.

Some might argue that because of compression technologies

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[54]Alfred Balk, The Myth of American Eclipse: The New Global Age 80 (1990).

[55]Tadashi Tamaki, Japan's Chip Market Reign May Be Over, The Nikkei Weekly, Nov. 16, 1992, at 8.

[56]Michiyo Nakamoto, US Set to Reclaim Chip Sales Top Spot, Financial Times, Dec. 11, 1992, at 7.

much of the future growth is in software, not "chips and glass," and the United States long has dominated the $120 billion a year software industry. But Edward Yourdon, a software consultant and author of The Decline and Fall of the American Programmer, claims that because of lower labor costs overseas, American "computer programmers will meet the same fate that befell American autoworkers in the 1970s and 1980s at the hands of the Japanese." Indeed, the quality of United States developed software already lags six other nations, including Japan, according to a survey by Software Productivity Research, Inc. "We assume that our supposed edge in creativity and innovation will continue to make us dominant," Yourdon says. "But a huge part of the software industry involves mature technologies and that's an area in which the United States will be vulnerable."[57] On the other hand, a recent General Accounting Office report on American competitiveness in various advanced technologies did not even consider software because, "We knew we were ahead there, so it doesn't worry us," according to Allan I. Mendelowitz, who supervised the study.[58]

As the United States works on a digital HDTV standard, the European Community continues development of an analog high-definition system under the guise of industrial policy that

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[57]John Markoff, U.S. Lead in Software Faces a Rising Threat, N.Y. Times, Oct. 25, 1992, at E16.

[58]G. Pascal Zachary, U.S. High-Tech Firms Have Begun Staging Little-Noticed Revival, Wall St. J., Dec. 14, 1992, at A1, A4.

"looks suspiciously like protectionism."[59]

Some participants in the HDTV discussion already have considered the compromises in quality and technology that are attendant with adoption of a standard at too early a stage. "The issues at stake are now much more important than U.S. versus Japan, Japan versus U.S., Europe versus Japan, or the U.S. and any other permutation one may care to put forward," writes Richard Jay Soloman of the Massachusetts Institute of Technology. He, too, says that a mere doubling of the number of lines is not good enough, and he particularly is disturbed that a technology will be adopted that endorses an image that "gets fuzzier as the picture gets larger and larger."[60]

Gary Demos of DemoGraFX, a small visual special effects company, says, "The 40 year durability of NTSC is unlikely to be duplicated given the rapid pace of technology. . . . HDTV architecture should consider upward scalability and extensibility, in order to allow advances in state of the art, while not obsoleting previously produced shows and equipment." He proposes an "HDTV hierarchy" of compatible formats for different resolution receivers.[61] This would be one way of doubling current proposed HDTV standards, as film director Coppola suggests. Such a plan might allow manufacture of

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[59]Roger Cohen, Europe's State-Industry Ties: Successes, and Utter Failures, N.Y. Times, Nov. 8, 1992, at A1, A6.

[60]Richard Jay Soloman, HDTV: Digital Technology's Moving Target? Intermedia, Mar.-May 1990, at 58, 59-61.

[61]...Digital Hierarchy, HDTV Report, Oct. 16, 1991, at 4.

receivers of varying sophistication, sparing consumers the burden of unwanted higher costs.

Conclusion

Industry has been reluctant to develop HDTV unless a market could be shown to exist. A market will not develop unless programming is available. By setting a standard and mandatory phase-in period, the FCC will guarantee both a market and programming, circumventing the chicken-or-the-egg debate that long has plagued the HDTV debate.[60] With that guarantee the industry will no longer be reluctant to produce high-definition receivers and ancillary equipment such as VCRs.

But perhaps more important, the United States policy on HDTV has been inadvertently useful in two respects: 1) It has stopped the Japanese technological "tsunami," and 2) it has slowed the push for adoption of a worldwide HDTV standard (based on Japanese technology) to allow a higher quality digital system to be developed. But neither of these developments will help the American television industry, and the push for HDTV will cost consumers billions of dollars. Perhaps an even greater slowing in the rush to standards would allow a more advanced technology to evolve while saving consumers money.[61] Further, it would

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[60]The Big Picture, supra note 8, at 79.

[61]For example, Tele-Communications Inc., the nation's largest cable television company, announced on December 2, 1992, that it would begin offering digital cable to 1 million customers in 1994 through the use of digital-to-analog converters in the homes. That could allow the company to increase the number of channels

allow industry time to develop a manufacturing infrastructure to be competitive with Japanese and other manufacturers. This is what some Europeans, who already have a television system with better resolution than the United States has, are advocating. They are hoping that "a superior all-digital system (or, at least, the underlying technology) emerges from the United States' process."[64] As Nicholas Negroponte of the Massachusetts Institute of Technology's Media Lab has said: "The picture quality has got to be a lot better than what has been proposed. You can't just double the number of scan lines; you need a tenfold increase for a big difference."[65] Thus far, HDTV seems to be an example of the pursuit of technology for technology's sake with consumers about to foot the bill for something they have not asked for.

All this is not to say that HDTV technology and standards are not important and should not be pursued. But America should not delude itself. The standard-setting process and the virtually enforced obsolescence of NTSC receivers can be accepted

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offered to each subscriber to more than 500. "This is just the beginning. This first round of products is the first of an evolution. We want to deliver a broad range of services adapted to the individual needs of the consumer," said John Malone, the company's chief executive officer. Mark Robichaux, Need More TV? TCI May Offer 500 Channels, Wall St. J. Dec. 3, 1992, at 1B. Because of the relative immaturity of compression technologies, there is every reason to expect similarly astonishing announcements from the broadcast industry and HDTV developers as digital compression technologies are refined.

[64]Farrell & Shapiro, supra note 6, at 74.

[65]Today's Leaders Look to Tomorrow, Fortune, Mar. 26, 1990, at 121.

for what it is: a de facto industrial policy that probably will not help United States industry. And the reality is that that industrial policy will cost consumers billions of dollars for what may be a negligible and unsought improvement in their lives and no likely recovery in the American consumer electronics industry. Or, as The Economist sarcastically noted: "Granted, Lifestyles of the Rich and Famous would be even more enjoyable if displayed in finer detail. The question is how much consumers would be willing to pay for this enrichment of their viewing pleasure."[66] More to the point, should consumers be forced to pay? And who benefits?

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[66]Big Television, Big Deal, The Economist, Oct. 3, 1992, at 90.